New Fuel Cells Successful at Watervliet Arsenal

By Nicholas Josefik, ERDC-CERL

A one-year demonstration of proton-exchange membrane (PEM) fuel cells at Watervliet Arsenal, NY, has shown this emerging technology to be promising for future Department of Defense (DoD) use. The demonstration was part of the Congressionally funded DoD Fuel Cell Program managed by the U.S. Army Engineer Research and Development Center (ERDC).

The project evaluated ten 5-kW PEM fuel systems manufactured by Plug Power, Inc., which operated for more than 83,000 hours and generated about 214,000 kWh of electricity throughout the year. The units operated at or above 94% average availability, exceeding the contract requirement of 90%. PEM fuel cells are ultimately intended for residential use.

Fuel cells provide distributed electrical power generation by producing electricity and heat from an electrochemical reaction with a hydrogen rich fuel. When pure hydrogen is used as a fuel, the fuel cell produces electricity, heat and water vapor with no other byproducts. Distributed generation provides high availability and secure power because the electrical generation is completed on site. There is no need for long transmission lines that are vulnerable to attack.

PEM fuel cells provide electricity for four family housing units at Watervliet Arsenal.

Contractors installed Watervliet's PEM fuel cells in January 2002.

"The fuel cell systems showcased an electricity source that is quiet, environmentally positive and holds significant promise for our military infrastructure," said COL Donald C. Olson, Commander, Watervliet Arsenal. "These systems served the Arsenal by providing some or all of the power required for three facilities in a way that was transparent to the Arsenal staff and its residents."

ERDC's Construction Engineering Research Laboratory (CERL) began the Residential Scale PEM Fuel Cell Demonstration Program in FY01. Plug Power responded to a Broad Agency Announcement with a proposal to place 10 PEM units at three base sites located on Watervliet Arsenal. Each 5-kW fuel cell unit is grid-connected and uses natural gas as the fuel. These fuel cells were installed and began producing power in January 2002.

The three base sites chosen for this project include Quarters 19, Building 115, and Building 110. Quarters19 is a historic building that has been converted into housing to accommodate four separate residences. Four PEM fuel cells were placed at this site — one unit for each residence. Building 115 is a laboratory facility and three units were placed at this site to support a destructive testing laboratory located inside. The final site, Building 110, is a heavy machining facility. Three units were placed there to support an Arsenal telecommunications room.

After one year of operation at the Arsenal, the PEM fuel cells have demonstrated performance not achieved previously with this technology. Two of the systems set longevity records for fully integrated PEM fuel cells operating in the field. The unit at Building 115 had a total of 6742 hours on the cell stack while the one at Quarters 19 ran for 7056 hours on one cell stack. During the demonstration period, the 10 PEM units averaged 93.7% availability.

With the demonstration completed, control of the fuel cell systems was transferred back to Plug Power, which will continue to operate the units at Watervliet.

The DoD Fuel Cell Demonstration Program assesses fuel cell performance at installations and provides feedback to industry in efforts to help bring this technology to commercialization. For more information on this technology or the demonstration program, please contact Frank Holcomb at CERL, 217-352-6511, ext. 7412 or 800-USA-CERL, Franklin.H.Holcomb@erdc.usace.army.mil.

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